Docket No.: 740709-000535

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Patent Application of:	)	Group Art Unit: 2855
Iwao SAKAI et al.	)	Examiner: Harshad R. Patel
Application No.: 10/529,400	)	Confirmation No.: 6747
Filed: March 28, 2005	)	
For: METHOD AND APPARATUS FOR	)	
MEASURING FLOW RATE OF FLUID	)	Date: November 13, 2007

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APPEAL BRIEF

Sir:

In accordance with the provisions of 35 U.S.C. § 134 and 37 C.F.R. § 41.37, Appellants submit this Appeal Brief in support of the Notice of Appeal filed July 13, 2007, to appeal the Examiner's final rejections in the Final Office Action of February 16, 2007, and in response to Advisory Action of May 25, 2007, and the Supplemental Advisory Action of June 7, 2007.

I. REAL PARTY IN INTEREST

Avance Techne Accent Corp. is the assignee and real party in interest.

II. RELATED APPEALS AND INTERFERENCES

There are presently no appeals or interferences known to the Appellants, the Appellants' representative, or the assignee, which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

For the purposes of this Appeal, claims 1-12 and 17-22 have been rejected. Thus, this Appeal is taken from the rejection of claims 1-12 and 17-22, as submitted in the Appendix herewith.

IV. STATUS OF AMENDMENTS

Claims 1-26 were filed in this application, and claims 13-16 and 23-26 were cancelled in the Amendment After Final filed May 16, 2007, subsequent to the Final Office Action of February 16, 2007. These amendments were entered by the Examiner, , as is indicated in the Advisory Action mailed May 25, 2007, and the Supplemental Advisory Action mailed June 7, 2007. Therefore, the amended versions of these claims should be considered on this Appeal.

V. SUMMARY OF CLAIMED SUBJECT MATTER

This Appeal is taken from claims 1-12 and 17-22, of which claims 1 and 17 are independent.

Independent claim 1 relates to a method for measuring a flow rate of a fluid moving in a tube which comprises the steps of:

(1) preparing a flowmeter comprising a set of a first upstream side shock wave-generating piezoelectric element and a first downstream side shock wave-receiving piezo-electric element and a set of a second downstream side shock wave-generating piezoelectric element and a second upstream side shock wave-receiving piezoelectric element arranged on

a surface of the tube under such condition that the shock wave-generating piezoelectric element and the shock wave-receiving piezoelectric element of each set are arranged along a fluid-moving direction apart from each other at an equivalent distance (See Para. [0011] of the published application);

(2) causing movement of the fluid in the tube and, while the fluid is moving, an impulse voltage with steep rising edge or steep falling edge is applied to the first shock wave-generating piezoelectric element to generate a shock and transmit the shock through a wall of the tube into the moving fluid so as to produce a shock wave in the moving fluid (See Para. [0012] of the published application);

(3) transmitting the shock wave through the moving fluid and receiving the transmitted shock wave by the first shock wave-receiving piezoelectric element through the wall of the tube (See Para. [0013] of the published application);

(4) while the fluid is moving, an impulse voltage with steep rising edge or steep falling edge is applied to the second shock wave-generating piezoelectric element to generate a shock and transmit the shock through the wall of the tube into the moving fluid so as to produce a shock wave in the moving fluid (See Para. [0014] of the published application);

(5) transmitting the shock wave generated in the step (4) through the moving fluid and receiving the transmitted shock wave by the second shock wave-receiving piezoelectric element through the wall of the tube (See Para. [0015] of the published application);

(6) processing data of the wave received in the step (3) and data of the wave received in the step (5) to obtain data of a composite wave and detecting a predetermined characteristic value from the data of the composite wave (See Para. [0016] of the published application);

(7) preparing a relationship between a moving rate of the fluid and the same characteristic value of data of a composite wave corresponding to the moving rate separately (See Para. [0017] of the published application); and

(8) comparing the characteristic value of data of the composite wave obtained in the step (6) with the relationship obtained in the step (7), to calculate the flow rate of the fluid of the step (2). (See Para. [0018] and Para. [0019]-[0028] of the published application).

Independent claim 17 relates to a method for measuring a flow rate of a fluid moving in a tube which comprises the steps of:

(1) preparing a flowmeter comprising a set of a first upstream side shock wave-generating piezoelectric element and a first downstream side shock wave-receiving piezo-electric element and a set of a second downstream side shock wave-generating piezoelectric element and a second upstream side shock wave-receiving piezoelectric element arranged on a surface of the tube under such condition that the shock wave-generating piezoelectric element and the shock wave-receiving piezoelectric element of each set are arranged along a fluid-moving direction apart from each other at an equivalent distance (See Para. [0030] of the published application);

(2) causing movement of the fluid in the tube and, while the fluid is moving, an impulse voltage with steep rising edge or steep falling edge is applied to the first shock wave-generating piezoelectric element to generate a shock and transmit the shock through a wall of the tube into the moving fluid so as to produce a shock wave in the moving fluid (See Para. [0031] of the published application);

(3) transmitting the shock wave through the moving fluid and receiving the transmitted shock wave by the first shock wave-receiving piezoelectric element through the wall of the tube to measure a period of time required for the transmission of the shock wave from the first shock wave-generating piezoelectric element to the first shock wave-receiving piezoelectric element (See Para. [0032] of the published application);

(4) while the fluid is moving, an impulse voltage with steep rising edge or steep falling edge is applied to the second shock wave-generating piezoelectric element to generate a shock and transmit the shock through the wall of the tube into the moving fluid so as to produce a shock wave in the moving fluid (See Para. [0033] of the published application);

(5) transmitting the shock wave generated in the step (4) through the moving fluid and receiving the transmitted shock wave by the second shock wave-receiving piezoelectric element through the wall of the tube to measure a period of time required for the transmission of the shock wave from the second shock wave-generating piezoelectric element to the second shock wave-receiving piezoelectric element (See Para. [0034] of the published application);

(6) obtaining a difference of the period of time measured in the steps (3) and (5) required for the transmission of the shock wave (See Para. [0035] of the published application);

(7) preparing a relationship between a moving rate of the fluid and a difference of period of time required for transmission of shock wave from the shock wave-generating piezoelectric element to the shock wave-receiving piezoelectric element separately (See Para. [0036] of the published application); and

(8) comparing the period of time required for the transmission of shock wave obtained in the step (6) with the relationship obtained in the step (7), to calculate the flow rate of the fluid of the step (2). (See Para. [0037] and [0038]-[0039] of the published application).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The ground of rejection to be reviewed on appeal is:

- The rejection of claims 1-12 and 17-22 under 35 U.S.C. § 103(a) as being unpatentable over admitted prior art (APA) in view of U.S. Patent Publication No. 20040050176 to Ohnishi.

VII. ARGUMENTS

A. The Rejection of claims 1-12 and 17-22 under 35 U.S.C. § 103(a) as being Unpatentable over Admitted Prior Art (APA) in view of U.S. Patent Publication No. 20040050176 to Ohnishi should be REVERSED.

Claims 1-12 and 17-22 were rejected in the final Office Action of February 16, 2007, under 35 U.S.C. § 103(a) as being unpatentable over admitted prior art (APA) in view of U.S. Patent Application Publication No. 20040050176 to Ohnishi.

In particular, the Examiner asserted that the only inventive feature in the instant invention is the use of the shock-wave generating piezoelectric element. The Examiner further asserted that Ohnishi teaches the use of oscillation wave generating and receiving piezoelectric devices in the same arrangements as the APA positions the ultrasonic piezoelectric transducers, and that it would have been obvious to a person having ordinary skill in the art at the time the invention was made to use the oscillation wave generating and receiving piezoelectric elements for the known ultrasonic wave generating and receiving piezoelectric elements since such are mere alternatives that would function equally in the environment of measuring flow in a conduit without being in direct contact with the fluid.

In addition, in the Advisory Action of June 7, 2007, the Examiner further asserted that Ohnishi teaches an ultrasonic flow rate sensor including an oscillation wave generating means (2a, 2b) which generate and detect oscilation waves generated by a pulse generating means generated by applying a voltage pulse to the piezoelectric elements of the transducers, and that, Fig 4 wave S1 is nothing more than a pulsed signal generated by a pulse generating means. The Examiner also asserted that the oscillation wave of Ohnishi is nothing more than a shock wave since the voltage source is used to generate a shock wave in the instant invention and thus when a voltage source is used to generate a shock wave in the instant invention, then similarly and inherently the voltage source used in the reference would generate a shock wave in the piezoelectric element and also Fig. 4 shows steep rising and steep falling edges. The Examiner further asserted that even though the reference does not explicitly use the term "shock wave," it is inherent that the voltage source which is applied to the piezoelectric element would inherently generate the shock wave in the transducer. Moreover, the Examiner argued that Appellants have admitted that the oscillation wave is regarded as a shock wave, and asserted that such an admittance is acknowledged as an alternative type or name of a wave applied to a piezoelectric element.

However, Appellants submit that neither Ohnishi nor the APA, taken alone or in combination, disclose, suggest, or render obvious the invention recited in claims 1-12 and 17-22, for at least the following reasons.

1. Ohnishi Fails to Disclose, Suggest, or Render Obivous the Use of a Shock Wave-Generating Piezoelectric Element to Measure a Flow Rate of a Fluid Moving in a Tube

Contrary to the Examiner's statement that "the only inventive feature in the instant invention is the use of the shock-wave (Oscillation Wave) generating piezoelectric element," pending claims 1-12 and 17-22 are directed to *methods for measuring a flow rate of a fluid moving in a tube*, which are not taught by, and are clearly distinguishable from, Ohnishi.

For example, the flow rate measuring-method described by Ohnishi, which is described, for example, in paragraphs [0026]-[0027], provides that:

> The present inventor has studied the conventional clamp-on ultrasonic flowmeter ... with respect to prolongation of the distance of ultrasonic wave transmission transmitting in the fluid by varying materials of the ultrasonic wave generating-detecting means and ultrasonic wave-propagating member and further trying various combinations of these materials. As a result, the inventor has acknowledged that it is very difficult to measure with a high accuracy a flow rate of a fluid moving in a tube having a small inner diameter.
>
> For the above-described reason, the inventor has considered to utilize an oscillation wave which is transmitted in a wall of a tube and made detailed analysis on this oscillation wave. Heretofore, this oscillation wave has been considered to be a noise in the measurement of a flow rate. As a result, the inventor has discovered that the oscillation wave transmitted in the wall of the tube can be utilized to measure a flow rate of a fluid moving in the tube.

Then, Ohnishi describes his flow rate-measuring method as follows, in paragraphs [0029] - [0035].

> The present invention resides in a method for measuring a flow rate of a fluid moving in a conduit which comprises the steps of:
>
> ...
>
> (3) generating an oscillation wave in the oscillation wave-generating means and applying the wave onto the wall;
>
> (4) measuring a period of time required for transmitting the generated oscillation wave to the oscillation wave-detecting means in the wall which oscillates in conjunction with the fluid moving with oscillation...

As for the voltage waveform, Ohnishi discloses the use of sine wave voltage, in paragraph [0157].

As would clearly be appreciated by a person of ordinary skill in the art, the inventive idea of Ohnishi resides in the use of an oscillation wave transmitted in the wall for the flow

rate measurement. This should be contrasted to the conventional flow rate measuring method utilizing an oscillation wave transmitted in the moving fluid.

The methods of Ohnishi are further contrasted with the claimed methods of the invention, which involve *producing a shock wave by applying an impulse voltage with steep rising edge or steep falling edge to a piezoelectric element*, and *measuring flow-rate by measuring a period of time required for transmitting the generated shock wave through the moving fluid.*

Ohnishi fails to disclose at least these features.

2. Ohnishi Fails to Disclose, Suggest, or Render Obivous the Use of a Shock Wave as is Recited in the Claims

Contrary to the Examiner's assertions that Appellants have admitted that the oscillation wave is regarded as a shock wave, a shock wave may be one type of oscillation wave, but *not every oscillation wave is necessarily a shock wave.*

For example, Appellants agree that Ohnishi discloses an ultrasonic flow rate sensor including an oscillation wave generating means which generates and detects oscillation waves generated by a pulse generating means generated by applying a voltage pulse to the piezoelectric elements of the transducers. However, *the oscillation wave used by Ohnishi is not a shock wave.*

As was previously presented to the Examiner in the Amendment filed January 25, 2007, a "shock wave" is distinct from an "oscillation wave." In particular, as defined by the McGraw-Hill "DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS, Third Edition," an "oscillation" is "any effect that varies periodically back and forth between two values," and a "shock wave" is "a fully developed compression wave of large amplitude, across which density, pressure, and particle velocity changes drastically."

These two terms are clearly distinct from one another, and there is no specific relationship between a shock wave and an oscillation wave. Appellants again stress the fact that oscillation waves are not necessarily shock waves, and *the use of shock waves in the invention results in unexpected and significant benefits not achievable by the oscillation waves disclosed by Ohnishi.* For example, Tables 1 and 2, on pages 24 and 25 of the

Specification, and Fig. 16, clearly show that the flow rate-measuring method of the invention easily gives the flow rate of the fluid under measurement with a high accuracy. This utility is not attainable using the methods of Ohnishi.

With respect to the Examiner's specific assertions, the wave S1 in Fig. 4 of Ohnishi is not a shock wave as recited in the claims. In particular, the shock wave of the invention is generated by a piezoelectric element by applying an impulse voltage thereto with a steep rising edge or a steep falling edge. (See Figs. 6-8 and 10-12, reference number 7). In contrast, the wave S1 shown in Fig. 4 of Ohnishi is not a wave generated by a piezoelectric element but is instead simply a wave applied to an ultrasonic transducer. (See Ohnishi, Paragraph [0102]).

Moreover, Ohnishi discloses that, with respect to the voltage wave (S1) in Fig. 4, the fourth period of a sine curve voltage (frequency 52 kHz, amplitude (peak-to-peak): 30 V) was applied the first oscillation wave generating-detecting means. (See Ohnishi, Paragraph [0157]). *Thus, Ohnishi does not disclose that S1 in Fig. 4 is a wave form of a wave generated by the ultrasonic transducer, but is instead a wave form of a wave applied to the ultrasonic transducer, and further that S1 not a shock wave but rather a sine curve.* Thus, the oscillation wave of Ohnishi is clearly distinguishable from the shock wave of the invention, which is generated by applying an impulse voltage with a steep rising or a steep falling edge to a piezoelectric element.

Therefore, Ohnishi completely fails to disclose or suggest the use of shock wave generated by a piezoelectric element for the measuring a flow rate of a fluid moving in a tube.

3. <u>The Inventive Concepts of the Ohnishi System and the Flow Rate Measurement Systems of the Invention are Clearly Distinct</u>

In addition to the distinctions explained above, Appellants again point out the differences between the flow rate measuring system of the invention and the system of Ohnishi. For example, the inventive concept of the Ohnishi system resides in the use of an oscillation wave transmitted in the wall for the flow rate measurement. (See Ohnishi, Abstract and claim 1). This can be contrasted from a conventional flow rate measuring method in which an oscillation wave transmitted in the moving fluid is utilized. This is further contrasted from the flow rate-measuring method of the invention, which utilizes a

shock wave transmitted in the moving liquid. The Examiner has failed to appreciate these distinctions.

Accordingly, for at least the above reasons, Appellants respectfully submit that neither the APA nor Ohnishi, taken alone or in combination, disclose, suggest, or render obvious the invention recited in pending claims 1-12 and 17-22. Therefore, the outstanding rejections of claims 1-12 and 17-22 under 35 U.S.C. § 103(a) in view of the APA and Ohnishi should be overturned.

Respectfully submitted,
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Date: November 13, 2007

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VIII. CLAIMS APPENDIX

1. A method for measuring a flow rate of a fluid moving in a tube which comprises the steps of:

(1) preparing a flowmeter comprising a set of a first upstream side shock wave-generating piezoelectric element and a first downstream side shock wave-receiving piezoelectric element and a set of a second downstream side shock wave-generating piezoelectric element and a second upstream side shock wave-receiving piezoelectric element arranged on a surface of the tube under such condition that the shock wave-generating piezoelectric element and the shock wave-receiving piezoelectric element of each set are arranged along a fluid-moving direction apart from each other at an equivalent distance;

(2) causing movement of the fluid in the tube and, while the fluid is moving, an impulse voltage with steep rising edge or steep falling edge is applied to the first shock wave-generating piezoelectric element to generate a shock and transmit the shock through a wall of the tube into the moving fluid so as to produce a shock wave in the moving fluid;

(3) transmitting the shock wave through the moving fluid and receiving the transmitted shock wave by the first shock wave-receiving piezoelectric element through the wall of the tube;

(4) while the fluid is moving, an impulse voltage with steep rising edge or steep falling edge is applied to the second shock wave-generating piezoelectric element to generate a shock and transmit the shock through the wall of the tube into the moving fluid so as to produce a shock wave in the moving fluid;

(5) transmitting the shock wave generated in the step (4) through the moving fluid and receiving the transmitted shock wave by the second shock wave-receiving piezoelectric element through the wall of the tube;

(6) processing data of the wave received in the step (3) and data of the wave received in the step (5) to obtain data of a composite wave and detecting a predetermined characteristic value from the data of the composite wave;

(7) preparing a relationship between a moving rate of the fluid and the same characteristic value of data of a composite wave corresponding to the moving rate separately; and

(8) comparing the characteristic value of data of the composite wave obtained in the step (6) with the relationship obtained in the step (7), to calculate the flow rate of the fluid of the step (2).

2. The method of claim 1, wherein the voltage applied by the impulse voltage in the steps (2) and (4) is constant until the generation of the shock in the shock wave-generating piezoelectric element ceases.

3. The method of claim 2, wherein the voltage applied by the impulse voltage in the steps (2) and (4) is kept constant until the shock wave-receiving piezoelectric element receives the shock wave in the steps (3) and (5).

4. The method of claim 1, wherein the processing for obtaining the data of the composite wave in the step (6) is performed by obtaining a difference between the data of the wave received in the step (3) and the data of the wave received in the step (5).

5. The method of claim 1, wherein the characteristic value to be detected in the steps (6) and (7) is a height of a wave appearing in a predetermined position in the composite wave.

6. The method of claim 1, wherein the characteristic value to be detected in the steps (6) and (7) is a height of a highest wave in the composite wave.

7. The method of claim 1, wherein the characteristic value to be detected in the steps (6) and (7) is an integral value of an absolute value of the composite wave.

8. The method of claim 1, wherein the characteristic value to be detected in the steps (6) and (7) is an integral value of absolute values of wave components in a period predetermined within a period from a first wave component to a tenth wave component of the composite wave.

9. The method of claim 1, wherein the characteristic value to be detected in the steps (6) and (7) is an integral value of an absolute value of a highest wave of the composite wave.

10. The method of claim 1, wherein the first upstream side shock wave-generating piezoelectric element serves as the second upstream side shock wave-receiving piezoelectric element and the first downstream side shock wave-receiving piezoelectric element serves as the second downstream side shock wave-generating piezoelectric element.

11. The method of claim 1, wherein the first downstream side shock wave-receiving piezoelectric element serves as the second upstream side shock wave-receiving piezoelectric element.

12. The method of claim 1, wherein the first downstream side shock wave-generating piezoelectric element serves as the second upstream side shock wave-generating piezoelectric element.

13-16. (Canceled)

17. A method for measuring a flow rate of a fluid moving in a tube which comprises the steps of:

(1) preparing a flowmeter comprising a set of a first upstream side shock wave-generating piezoelectric element and a first downstream side shock wave-receiving piezoelectric element and a set of a second downstream side shock wave-generating piezoelectric element and a second upstream side shock wave-receiving piezoelectric element arranged on a surface of the tube under such condition that the shock wave-generating piezoelectric element and the shock wave-receiving piezoelectric element of each set are arranged along a fluid-moving direction apart from each other at an equivalent distance;

(2) causing movement of the fluid in the tube and, while the fluid is moving, an impulse voltage with steep rising edge or steep falling edge is applied to the first shock wave-generating piezoelectric element to generate a shock and transmit the shock through a wall of the tube into the moving fluid so as to produce a shock wave in the moving fluid;

(3) transmitting the shock wave through the moving fluid and receiving the transmitted shock wave by the first shock wave-receiving piezoelectric element through the wall of the tube to measure a period of time required for the transmission of the shock wave from the first shock wave-generating piezoelectric element to the first shock wave-receiving piezoelectric element;

(4) while the fluid is moving, an impulse voltage with steep rising edge or steep falling edge is applied to the second shock wave-generating piezoelectric element to generate a shock and transmit the shock through the wall of the tube into the moving fluid so as to produce a shock wave in the moving fluid;

(5) transmitting the shock wave generated in the step (4) through the moving fluid and receiving the transmitted shock wave by the second shock wave-receiving piezoelectric element through the wall of the tube to measure a period of time required for the transmission of the shock wave from the second shock wave-generating piezoelectric element to the second shock wave-receiving piezoelectric element;

(6) obtaining a difference of the period of time measured in the steps (3) and (5) required for the transmission of the shock wave;

(7) preparing a relationship between a moving rate of the fluid and a difference of period of time required for transmission of shock wave from the shock wave-generating piezoelectric element to the shock wave-receiving piezoelectric element separately;

and

(8) comparing the period of time required for the transmission of shock wave obtained in the step (6) with the relationship obtained in the step (7), to calculate the flow rate of the fluid of the step (2).

18. The method of claim 17, wherein the voltage applied by the impulse voltage in the steps (2) and (4) is kept constant until the generation of the shock in the shock wave-generating piezoelectric element ceases.

19. The method of claim 18, wherein the voltage applied by the impulse voltage in the steps (2) and (4) is constant until the shock wave-receiving piezoelectric element receives the shock wave in the steps (3) and (5).

20. The method of claim 17, wherein the first upstream side shock wave-generating piezoelectric element serves as the second upstream side shock wave-receiving piezoelectric element and the first downstream side shock wave-receiving piezoelectric element serves as the second downstream side shock wave-generating piezoelectric element.

21. The method of claim 17, wherein the first downstream side shock wave-receiving piezoelectric element serves as the second upstream side shock wave-receiving piezoelectric element.

22. The method of claim 17, wherein the first downstream side shock wave-generating piezoelectric element serves as the second upstream side shock wave-generating piezoelectric element.

23-26. (Canceled)

IX. EVIDENCE APPENDIX

There is no evidence related to this Appeal.

X. RELATED PROCEEDINGS APPENDIX

There are no related proceedings to this Appeal.